National Laboratory of the Rockies

REQUEST FOR INFORMATION (RFI)

Pilot-Scale Hollow Fiber Fabrication Line

RFI-2026031395

Date of Issuance: August 5, 2026

Response Deadline: August 27, 2026, 5:00PM, Mountain Time

1.0 Background

The National Laboratory of the Rockies (NLR) is the U.S. Department of Energy's primary national laboratory for energy systems research and development. As the energy systems laboratory, NLR's unique strength lies in developing and integrating a broad array of energy technologies into robust, resilient systems - bridging foundational research with practical applications to lower energy costs, drive economic growth, bolster national security, and deliver abundant and reliable energy

This is a Request for Information (RFI) issued by the Alliance for Energy Innovation, LLC. The purpose of this RFI is to conduct market research and gather information on the current capabilities of potential sources to provide a Pilot-Scale Hollow Fiber Fabrication Line.

The membrane sector needs flexible, accessible manufacturing equipment to research and develop membrane production processes at scale. NLR will establish a national research facility to address scale-up and manufacturing challenges and enable cost-effective fabrication of innovative membranes for a variety of separations processes. NLR's goal is to establish a R&D center focused on enabling a more competitive U.S. industrial sector through creation of national laboratory capabilities that address R&D challenges in membrane development and production. A key piece of this center is a pilot-scale, hollow fiber membrane production line capable of producing a broad range of hollow-fiber-based separations membranes. The purpose of this line will be to conduct research, process development, optimization, and small-scale pilot production. NLR's seeks a unique fabrication line that offers unparalleled flexibility in its modularity of unit operations and ability to fabricate membranes for a variety of applications.

2.0 Scope of Need

The information received in response to this RFI will guide Alliance's focus for writing a requirements document to meet our overall research goals. NLR is seeking information from sources that may be capable of providing a solution to the following:

15013 Denver West Parkway
Golden, CO 80401
Phone: 303-275-3000

The National Laboratory of the Rockies is a national laboratory of the U.S. Department of Energy, Office of Critical Minerals and Energy Innovation, operated under Contract No. DE-AC36-08GO28308.

A pilot-scale hollow fiber system that can produce hollow fiber membranes in a single, dual, or triple extrusion method. These membranes can be potted as modules for gas and liquid separation applications. Having a controlled, precise method to generate a high volume of hollow fiber membranes allows NLR to research novel hollow fiber membranes and their associated applications. It is crucial to have a system with a high level of control over every part of the fabrication process to ensure quality and consistency. A system with control over a large range of fabrication parameters (extrusion configuration, temperatures, flow rate, chimney conditions, coagulation bath conditions, etc.) will permit NLR to produce a wide array of hollow fiber membranes for diverse applications.

In the event a solicitation is released, NLR is seeking information from sources that may be capable of providing a solution that meets or exceeds the following minimum capabilities:

1. Fiber pulling and winding system capable of conveying and collecting fibers as slowly as 2 m/min and up to 35 m/min
2. Maximum line length: 35 ft
3. Three mixing vessels consisting of:
    a. A stainless steel, or preferable Hastelloy, double-walled vessel equipped with a jacket to permit heating and cooling fluid recirculation. The volume of this vessel should be at least 5 L
    b. Overhead stirring with stainless steel, preferable Hastelloy, stirring blade to permit mixing of polymer solutions in solvent. External coupling should be accomplished via a bearing, preferably stainless steel, Hastelloy, or ceramic.
    c. A heating and cooling system for water temperature control to a maximum of 80 °C
    d. Compressed gas inlets for inert gas supply for gas to blanket oxidizable chemistries
4. Three supply vessels consisting of:
    a. A stainless steel, or preferable Hastelloy, double-walled vessel equipped with a jacket to permit heating and cooling fluid recirculation. The volume of this vessel should be at least 5 L
    b. Overhead stirring with stainless steel, preferably Hastelloy, stirring blade to permit mixing for temperature uniformity. External coupling should be accomplished via a bearing, preferably stainless steel, Hastelloy, or ceramic.
    c. A heating and cooling system for water temperature control to a maximum of 80 °C
    d. Compressed gas inlets for inert gas supply for gas to blanket oxidizable chemistries
    e. Hookups for an in-line stainless steel filtration system capable of handling
5. Dope solution pumping capability consisting of:
    a. Heated tubing/hose connecting the three mixing vessels to the three dope supply vessels with in-line, heated filtration blocks consisting of stainless steel or Hastelloy filters. Tubing and filtration should be capable of being heated to 80 °C
    b. Pumping capabilities between the mixing vessels and filtration block leading to the dope supply vessels consisting of heated gear pumps which can be heated to 80 °C
    c. Heated tubing/hose connecting the three dope supply vessels to a heated spinneret with in-line, heated filtration blocks consisting of stainless steel or Hastelloy filters. Pressure monitoring within the tubing before and after the filter should be present

to monitor pressure development over time. Tubing and filtration should be capable of being heated to 80 °C

   d. Pumping capabilities between the dope supply vessels and filtration block leading to the heated spinneret consisting of heated gear pumps which can be heated to 80 °C

6. An extrusion operation following the dope solution pumping and supply consisting of:
   a. A semi-enclosed system containing an extrusion spinneret and heated, humidified gas flow whose environment can be controlled to a temperature up to 80 °C with humidity as low as 10% relative humidity and as high as 80% relative humidity over a wide temperature range (20 °C to 80 °C). The gas flow should be capable of providing nitrogen with temperature and humidity as described above over a range of 0.1 to 2.0 slpm.
   b. This semi-enclosed system should be positioned above the first coagulation bath
   c. The extrusion spinneret should be capable of producing single-layer hollow fibers by co-extrusion of one dope solution with an internal 'bore' solution or of producing multi-layer hollow fibers by co-extrusion of two dope solutions with one internal bore solutions. Co-extrusion should be accomplished by the extrusion of concentric, cylindrical shells of liquid from a series of fluid inlets through a series of concentric nozzles
   d. The extrusion spinneret should be capable of being heated to up to 80 °C
   e. The vertical position of the spinneret should be capable of being manually raised or lowered to a distance ranging from 0 to 50 cm above and below the first coagulation bath
7. Multiple baths and/or rinse tanks for phase inversion, solvent extraction, and chemical treatment, and dip coating processes. Baths should include recirculation, temperature control, and automatic filling/draining capability.
   a. Coagulation baths should consist of a stainless-steel tank with a minimum volume of 260 L and total winding path of 12 meters to permit a residence time per bath of at least 20 seconds per coagulation bath. Each bath should be capable of being heated to 80 °C, with temperature control enabled through measurement at multiple physical zones within each coagulation bath.
   b. Rinse baths should consist of a stainless-steel tank with a minimum volume of 150 L and total winding path of 12 meters to permit a residence time per rinse bath of at least 20 second per bath. This bath should be capable of safely housing water and solvent, and being heated to 80 °C with recipes that can be programmed for different bath compositions.
   c. Each bath, whether rinse baths or coagulation baths should each come equipped with one driven (by motor or otherwise) pulling wheel mounted on the outlet of the rinsing bath capable of pulling at the same speed as the winding system (from 2 m/min to 35 m/min).
   d. A water spray system should be mountable above the pulling wheel system to enable wetting of the fiber while outside of the coagulation baths, preventing full drying of the fiber.
   e. Liquid level monitoring and control should be included with the controls for the bath to prevent overfilling.

8. Water supplied to the system should include capabilities for a blending of hot and cold input building water, water softener that can operate at a maximum throughput of 600 L per hour with a maximum water temperature inlet of 65 °C
    a. Operations to heat and cool the process water should fit within the proposed footprint of this equipment
9. Modular construction of these operations to permit adjustment of the footprint and reconfiguration of the equipment to suit variable project needs (e.g., total number or length of coagulation baths).
10. A control system to enable programmatic control of all unit operations within this system (polymer solution mixing, temperature and pressure control, flow rate control, winding speed control, etc.). This system should be capable of recording all outputs of sensors within the system.
11. A separate, offline system to permit dip coating of fibers at similar speeds herein (2 m/min to 35 m/min).

3.0 Information Requested from Respondents

Please structure your response to address the following areas. This information will help us understand your ability to meet our potential needs.

3.1. Company Information

- Company Name, Address, and Website URL.
- Point of Contact (Name, Title, Email, and Phone Number).
- Company Overview (briefly describe your company, its size, and core competencies).
- Socio-Economic Status (e.g., Small Business, Woman-Owned, Veteran-Owned, 8(a), HUBZone, etc.) under the specified NAICS code.

3.2. Technical/Solution Approach

- Based on the "Scope of Need" in Section 2.0, describe your proposed solution, product, or methodology.

3.3. Pricing

- Provide a Rough Order of Magnitude (ROM) price estimate for your solution.
    - Note: ROM information is for budgetary and planning purposes only and does not constitute a formal bid or offer.

3.4. Key Questions and Technical Challenges

Key Questions:

NLR is interested in the following information to maximize relevance and value:

1. How practical is it to build a hollow fiber membrane fabrication line with the specific configurability described above?
2. What is the line's ability to support the integration of an array of sensors and analytical measurement tools, either as part of the original design or as retrofitted additions at a later date?

3. What is your specific experience in designing and building equipment for membrane R&D and/or commercial production?
4. What ranges of line speeds are available, and what methods are used to adjust the physical footprint (length, width, height) of this equipment to meet our desired sizes and coagulation bath residence times?
5. What is the potential for implementing a human-machine interface (HMI) capable of automatically sensing machine configurations and various unit process modules?
6. What is the range of power and utility requirements needed for different heating rates, process water temperature control, treatment specifications, and pump requirements?
7. Can you describe the compatibility of the bath materials available with acids, bases, organic solvents, and salt solutions?
8. What options are available to gradually replace the coagulation or rinse bath water during the active fabrication process?
9. Can you provide a high-level description of the safety features incorporated into the system and what outputs are available?

Example Technical Challenges:

A description of example technical challenges, with potential associated research and validation applications to address them, is included below. These examples are not exhaustive and are intended to only provide a starting point:

- The planned installed location for this equipment will be in a high-bay facility at NLR in Golden, CO. Based on the floorplan of the facility, the maximum length of the equipment is 35 ft. Space for operators and egress will be in addition to this length and do not need to be considered in the line length calculation. The width of the equipment is not constrained.
- We request this line to be capable of producing several types of hollow fiber membranes (asymmetric, multilayer, dip-coated) by coating fluids with various dope solutions (low viscosity and high viscosity). Fabrication of different types of membranes require different process units and/or different arrangements of process units. A technical challenge will be to design a line that can ensure flexibility to meet fabrication requirements for different technologies which may require a range of residence times in coagulation baths. This could be accomplished by including multiple rolls within a single coagulation bath, which could be of variable width, to permit longer or shorter residence times as needed at different operating line speeds.

4.0 Submission and Administration Instructions

- **Response Deadline:** All responses must be received by **August 27, 2026 at 5:00PM, Mountain Time**. Late responses may not be considered.
- **Format:** Responses should be submitted as a **PDF**. Please limit your response to **2-5 pages**, not including a cover page.
- **Method of Submission:** Responses must be submitted electronically to the following email address: ASP.Responses@nlr.gov.
    - The subject line should read: **RFI-2026031395: [Your Company Name]**

- **Small-Business Requirements:** Sufficient, qualified responses to this RFI will determine if a total small business set aside is appropriate for a resultant RFP. The NAICS code applicable to this RFI is **333248 All Other Industrial Machinery Manufacturing**. Links for convenience:
    - https://www.sba.gov/document/support--table-size-standards
    - https://www.sba.gov/size-standards
- **Estimated Lead Time**: for Implementation/Delivery to NREL

Disclaimer: Responding to this request identifies your company as an interested candidate only. Your submittal is not in response to a Request for Proposals (RFP). This is an RFI, not a Request for Proposal. All responses must be in writing via email and verbal replies will not be accepted. Project related questions or inquiries related to this posting will not be entertained at this point in the procurement process. Status of this posting or any action related to this posting thereafter will not be entertained. This document represents a market research effort. Any costs associated with the development of a response to this request will not be reimbursed by Alliance and submission does not guarantee or otherwise promise inclusion in any forthcoming RFP. In the event a solicitation results from this RFI, Alliance reserves the right to set aside in total or in part any resultant award. Should the Alliance elect not to proceed with a further solicitation, Alliance may or may not notify respondents of this decision.